Draft Environmental Assessment Delaware River Main Channel Deepening, June 2011
Delaware Department of Natural Resources and Environmental Control
Division of Fish and Wildlife (DFW)
Comments Regarding Atlantic Sturgeon, Oysters & Horseshoe crabs

Blasting in Atlantic sturgeon overwintering areas –

General Comment: Recent (unpublished 2011) telemetry data of overwintering Atlantic sturgeon locations (Figures 1 & 2) indicate juvenile Atlantic sturgeon presence in the federal channel (Marcus Hook Range) during the blasting window over rock and large cobble substrate in the area to be blasted. Five of the 6 transmitter sturgeon in the Delaware Estuary overwintered in the Marcus Hook Anchorage, Marcus Hook Bar and Marcus Hook Range area. The 6th fish overwintered above Philadelphia and was last detected at rkm 186 on January 10th, 2011. In 2009-2010, 12 of 20 transmitter implanted juvenile sturgeon overwintered in the Marcus Hook Anchorage, Range and Bar area. Manual tracking was not performed during the time of the blasting window for the 2009 sturgeon, however, late fall of 2009 tracking locations indicate some federal channel and near channel use (Figure 3). Telemetry data suggests that the Marcus Hook Anchorage, Range and Bar area is the Estuary's primary overwintering grounds for Atlantic sturgeon with some presence in the federal channel.

Blasting at other times of the year does not seem to be an option as the Marcus Hook Anchorage, Range and Bar area is a high use area for Atlantic sturgeon juveniles, year round. Receiver data from October 2009 to December 2010 in the Marcus Hook area indicates 53 individual transmitter implanted Atlantic sturgeon were detected there with no breaks in activity.

EA Report: Scare charges will be used for each blast.

Comment: There is very little data on sturgeon sound sensitivity. Initial studies by Meyer and Popper (unpublished) measured responses of the ear using physiological methods that suggest that a species of *Acipenser* may be able to detect sounds from below 100 Hz to perhaps 1,000 Hz or a bit more (Popper 2005); however, thresholds were not determined. These results suggest that sturgeon should be able to localize sound, but data are limited. There is limited evidence to suggest that a 45 second delay between scare charge detonation and blasting would be sufficient for sturgeon to move from the immediate area during cold water temperatures when activity levels are low (Figure 2). In the Cooper River Collins, Post and Elverton (2000) researched the effectiveness of scare charges to repel sturgeon and found that shortnose sturgeon moved 225 feet away from the source 4 minutes after post-detonation in warm water (Post pers. com).

Recommendation: The monitoring plan should include a plan to determine scare charge and drilling behavior during low water temperatures utilizing telemetry in the area. If measured response is slow DFW recommends additional scare blasts at least 4 to 5 minutes prior to rock blasting in addition to the 45 and 30 second scare blasts.

EA Report: Surveillance for schools of fish will be conducted by vessels with sonar fish finders within a zone of about 500 feet radius before each blast.

Comment: It is unclear to DFW if USACE is only minimizing impacts to schools of fish as opposed to individual fish or only used the term school to refer to more than one fish.

Due to the limited resolution of side-scan and fish finder Sonar systems it is unlikely to be an effective tool for determining juvenile sturgeons (<700 mm TL) at or near the bottom from other bottom structures. Used in addition, DIDSON technology may be adapted to be effective for verifying bottom dwelling fish from other bottom structure if it can be mounted approximately 20' off the bottom in a way to eliminate camera movement yet still allow for panning. When identifying fish with sonar, video is superior to still images even if the resolution is inferior due to the ability to observe movement.

Recommendation: Use side scan sonar to initially search for schools of fish in the surveillance zone. Then use a DIDSON to determine the presence of sturgeon. Clearly define threshold numbers for sturgeon that would constitute a delay in blasting. Provide a copy of the blasting plan to DFW when it is provided to NMFS.

EA Report: *Adverse impacts to fish will be further minimized by conducting blasting between December 1 and March 15 as recommended by the Delaware River Basin Fish and Wildlife Management Cooperative, and using controlled blasting methods such as delayed blasting and "stemming" to reduce the amount of energy that would impact fish.*

Recommendation: DFW requests that USACE investigate Green Break technology that uses forced gases instead of percussion to break rock which the manufacturer claims prevents injury to fish. The Department did not have time to fully research this product so we are unable to endorse it but it seems to be a promising alternative. http://www.miningweekly.com/article/non-detonating-technology-set-to-rock-the-demolition-market-2011-06-03
http://www.cardox.net/cardox/civils_case_study_lusail_08.html DFW is interested in working with the USACE to evaluate this technology in terms of its effect on fish mortality as an effective alternative to conventional blasting technology.

EA Report: *Monitoring impacts to fish from the blasting will also be conducted to verify that impacts are minimal.*

Comment: There is no clear plan for how post-blast monitoring will be conducted. If there is immediate mortality from blasting it will likely be from ruptured swim bladders. This will likely mean mortalities will not float so effective monitoring cannot be accomplished by simple visual observation.

Recommendation: Include an effective post-blast monitoring plan in the blast plan and provide a copy to DFW when it is provided to NMFS.

Atlantic sturgeon habitat loss –

General Comment: The movement of the salt line may change the suitability of existing Atlantic sturgeon habitat for juveniles. Telemetry studies in 2007 through 2011 have identified sturgeon habitat throughout the Estuary. However, areas near the freshwater interface <1.0 ppt are consistently the most concentrated (Figures 1-4). A comparison of juvenile telemetry study results from 1997 and 1998 to results from 2007 and 2008 indicate concentration areas shifted upstream approximately 3 to 5 miles. 2007 and 2008 were dry years, thus moving the freshwater interface upstream which in turn moved the concentration areas of sturgeon into upstream habitats (Fisher 2011). Any increase in salinity due to deepening will increase salt water incursion into these concentration areas and shift available habitat further upstream. The issue with this is that due to the shape of the estuary there is less deepwater habitat further upstream which represents a decrease in the available tidal freshwater habitat for Atlantic sturgeon juveniles. Decreased habitat is a decrease in the production capacity of the system.

The location of the Atlantic sturgeon spawning grounds is unknown. However, eggs and larvae need tidal freshwater to survive so any shrinkage of tidal freshwater habitat could be a potential loss or reduction of the spawning grounds.

Young of the year Atlantic sturgeon prefer freshwater (Hatin et al. 2007; McCord et al. 2007) so salt water incursion represents a shrinkage of their habitat. This loss is recently more significant due to the increased use of habitat at the freshwater interface below Philadelphia (Fisher 2011 and Figure 1). Lazzari (1986) documented young of year habitat as the upper tidal Delaware River. However, recent DFW telemetry of young of the year Atlantic sturgeon indicates the Cherry Island Flats to Mifflin anchorage is the primary nursery grounds with some use of the upper tidal river still occurring. Lingering low dissolved oxygen issues in the Philadelphia and Chester area into the late 1980's (Sharp 2010; Silldorff pers com.) may have prevented young of the year Atlantic sturgeon from using the freshwater areas below Chester during the Lazzari study. Preferred present day nursery grounds are near the freshwater interface and saltwater incursion represents a loss of habitat.

Hydraulic Dredging sturgeon mortality at the cutterhead –

General Comment: DFW is concerned about losses at the cutterhead. Even though the federal channel is <1% of the total area of the Estuary, sturgeon select for deepwater habitat. In 2007 and 2008 17% of telemetry locations were in the Federal channel with the majority of locations (61%) occurring in anchorages (Fisher 2011). Sturgeon spend considerable time at or near the bottom foraging in the summer months into the fall when hydraulic dredging is scheduled to occur (Figure 5) (reference Fisher 2011 for additional depth figures).

EA Report: In addition to the protection measures associated with blasting activities, NMFS approvedobservers will be onboard hopper and mechanical dredges to monitor for take of Atlantic sturgeon. Confined disposal facilities will be monitored for work utilizing hydraulic cutterhead suction dredges.

Comment: It is unclear how the disposal facilities will be monitored and if it will be done by a NMFS observer.

Recommendation: A NMFS observer should be placed at the disposal site during hydraulic dredging, as that is where any carcasses could be observed. A disposal site visit walk by DFW personnel on a tour of Kilcohook observed carcasses of channel catfish, gizzard shad and horseshoe crab several hundred yards from the effluent pipe where the sediment and solids begin to settle out of the flow. Walking in or near shallow water settling areas at disposal sites hourly would be the ideal method to observe for carcasses.

Beneficial Use of Dredged Material in Delaware Bay -

General Comment: DFW remains concerned about the "beneficial use" aspects of the project as outlined in Section 1.2.2 of the Draft EA.

Specifically, the placement and grain size of the proposed beneficial use materials are not consistent with the habitat conservation and restoration components of the Atlantic States Marine Fisheries Commission's Interstate Fishery Management Plan for Horseshoe Crab (ASMFC 1998). Grain size of the proposed placement materials at both the Kelly Island and Broadkill Beach sites may inhibit horseshoe crab egg development. Smith et al. (2002) concluded that the source of sediment for beach nourishment should be chosen to reflect a coarse estuarine beach. They further suggested that the material should have a gravel sub-fraction and have a mean sediment size of 0.35 to 0.50 mm in the sand fraction. Summarized data from Botton et al. (1994) indicated that the grain size of beaches that had the greatest horseshoe crab spawning concentrations in the Delaware Bay had grain sizes from 0.6 to 0.8mm, with a median grain size of 0.7mm (Brady and Schrading 1996). Penn and Brockmann (1994) found fine-grained, poorly drained sediments impeded egg development and eggs placed in course well-drained sediment were prone to desiccation. Recent work completed by the Department (Wilson and Madsen) indicated that the mean grain size of the sediments proposed for Broadkill Beach would be about 0.30 to 0.35mm, with a very small gravel fraction. The USACE has previously indicated in a correspondence to DNREC that, "typical sediment size (D50) for the sand to be used in the construction of Kelly Island is between 0.2 to 0.4 mm (medium to medium-fine sand), which will provide both a stable beach and suitable horseshoe crab habitat." Sediments of these sizes are likely to impede egg development and are, therefore, likely to be detrimental to horseshoe crabs.

In addition, the proposed construction schedule for the Kelly Island portion of the project is not consistent with the recommended seasonal restrictions for horseshoe crabs. The Interstate Fisheries Management Plan for Horseshoe Crab (ASMFC 1998) recommended seasonal restriction is April 15 through August 30 to avoid critical spawning and juvenile development periods. Although a modified schedule for proposed construction activities at Broadkill Beach was agreed to and is reflected in the "Delaware River Main Channel Deepening Proposed Project Schedule – December 2010", no such schedule modification is apparent for Kelly Island. The current landside construction schedule for Kelly Island indicates that work will be conducted from April through September. Construction activities during this period, particularly from late April through June, will have an immediate detrimental impact on spawning horseshoe crabs. Spawning adults have reached a size where their natural mortality is relatively low (Loveland et al. 1996). These mature crabs are immediately available to provide the necessary egg resources for migratory shorebirds and stock replenishment. Delaware Bay area state agencies, operating independently and through the ASMFC, have adopted stringent management measures to specifically protect these animals, particularly during their critical spawning period that coincides with the presence of migratory shorebirds. It is for these reasons that we question the benefits of this project relative to horseshoe crabs.

DFW's concerns regarding impacts to the oyster beds remain largely centered on the Kelly Island restoration plans. There has been no resolution to our concerns regarding the proximity of Delaware's oyster beds and their susceptibility to smothering by fine-grained sediment from the proposed project. Should the Kelly Island project be scrapped or modified significantly, then the only remaining question regarding oysters is the impact of higher salinity as a result of upstream movement of the salt wedge. Higher salinity patterns have been linked to increased rates of oyster disease and mortality.

June 2011 EA Supplemental Document titled "A Supplemental Biological Assessment for Potential Impacts to the New York Bight Distinct Population Segment of Atlantic Sturgeon (Acipenser oxyrinchus oxyrhincus) Which is Proposed for Federal Endangered Species Listing Resulting from the Delaware River Main Stem and Channel Deepening Project", March 2011

Delaware Department of Natural Resources and Environmental Control Comments Regarding Atlantic Sturgeon

3.1.3 General Sturgeon distribution within the New York Bight Distinct Population Segment

Biol. Asses.: *Juvenile Atlantic sturgeon are believed to overwinter in the deeper waters of the lower estuary.*

Comment: DFW telemetry studies have shown that juvenile Atlantic sturgeon overwinter primarily in the deeper waters of the estuary from Delaware Memorial Bridge to Roebling, NJ over various substrate types.

3.1.4 Distribution in Project Area

Biol. Asses.: *Juvenile Atlantic sturgeon are believed to overwinter in the deeper waters of the lower estuary and move upstream and inshore in spring in response to increasing water temperatures.*

Comment: Same correction as above.

Biol. Asses.: *Juvenile Atlantic sturgeon were most abundant in summer in the lower tidal portion of the Delaware River, most likely utilizing this area for foraging grounds. Numbers in August decreased in this area, the month of maximum water temperatures.*

Comment: More recent DFW (Fisher 2011) and DSU (Simpson and Fox 2008) telemetry and gillnetting surveys have found that during August juvenile sturgeon assemble into dense aggregations (near cooler, more oxygenated water input). These dense aggregation areas cause some foraging locations to decrease in numbers, however the number of juvenile fish in the system throughout the summer remains relatively constant.

Biol. Asses.: *Numbers of Atlantic sturgeon in the Delaware Bay increased slightly in September, while abundance decreased in the upper and lower tidal river the same month, suggesting a return to overwintering areas in late summer.*

Comment: DFW (Fisher 2011) and DSU (Simpson and Fox 2008) telemetry studies confirm outmigration of larger juveniles in late September and October. Fisher (2011) also noted that juveniles summering near the mouth of the Delaware Bay will sometimes make dramatic movements upstream in October as far as the Delaware Memorial Bridge and then turn around and head back offshore. This behavior lasts an average of 3 weeks.

Biol. Asses.: *Shirey (1997) identified two important concentration areas of Atlantic sturgeon during the spring and summer within the Delaware River (rkm 80-90 and rkm 115-125).*

Comment: It's important to note that Shirey was being specific to late stage juveniles. Fisher (2011) and Simpson and Fox (2009) identified an additional important area as rkm 125-130 in the summer and early fall for large juveniles.

Biol. Asses.: *Some juveniles may remain in the tidal freshwater reaches of the river to overwinter, as evidenced by the capture of an early juvenile in the lower tidal river in February by Burton et al. (2005) and the capture of several juveniles in the upper tidal river during December through February by Lazzari et al. (1986) and O'Herron (unpublished data).*

Comment: Refer to Fisher 2011 and Figure 1 for overwintering locations and detailed movement exchange between these areas.

Biol. Asses.: *Subadult Atlantic sturgeon in the Delaware River tended to occupy deepwater habitats outside of the main shipping channel where depths were maximized during the summer months (Simpson, 2008).*

Comment: Fisher (2011) quantified 2007 and 2008 late stage juvenile (subadult) tracking locations in the Federal channel, anchorage, alternate channel (Cherry Island and Pea Patch), and uncategorized as 17%, 61%, 5%, and 17% respectively.

5.1.1 Physical Injury During Construction

General Comment: First paragraph should also describe overwintering locations of juvenile sturgeon as in Figure 1 and 2.

Biol. Asses.: *Another potential direct physical injury to sturgeon may result from blasting operations. ….. The ROV results confirmed that sturgeon are using the Marcus Hook area in the winter months, although relative densities were much lower than those observed near Trenton, NJ,where concentrations of sturgeon occur in several large aggregations.*

Comment: DFW (Figure 1 and Fisher 2011) describe higher concentrations in the Marcus Hook Anchorage/Range/Bar area in the winter time.

Biol. Asses.: *Although Atlantic sturgeon mortalities from encounters with commercial vessels occur in the Delaware Estuary, the Main Channel Deepening Project will not increase the frequency of ship strikes since an increase in the number of ships traversing the river is not anticipated. The Main Channel 45-foot deepening will primarily reduce the lightering of crude oil tankers in the lower Delaware Bay, allowing vessels to off-load more of their crude oil directly at upriver port facilities. The distance between vessel keel and the deeper navigation channel bottom will essentially be the same as the current 40-foot depth within the channel*.

Comment: It remains in question whether the frequency of sturgeon/vessel strikes will not increase. Increased speeds due to the widening of bends and the increase in vessel size (i.e. propeller size) and vessels with increased loads (which require more thrust) will strain larger volumes of water at an increased rate which is likely to increase the number of ship strikes. A reduction in lightering may reduce the number of vessels but not the number of deep draft vessels which are believed to be the primary cause of vessel strikes.

Recommendation: USACE should assess sturgeon ship strikes pre and post deepening to improve our understanding of causes of sturgeon mortality.

5.1.2 Physical Injury Post construction

Biol. Asses.: *Atlantic sturgeon are anadromous, spending the majority of their adult phase in higher saline marine waters and migrating upriver to spawn in freshwater, then returning to brackish waters in juvenile growth phases.*

Comment: <0.5 ppt salinity is considered freshwater. Larval stages require <0.5 ppt and early juvenile Atlantic sturgeon life stages prefer <0.5 ppt freshwater. No early stage juveniles have been documented in the Delaware Estuary in >1.0 ppt salinity and is likely an intolerable condition at this life stage. Later stage juveniles return to brackish waters (>0.5 ppt). These life stage habitat requirements are significantly different and should be noted when discussing salinity.

Biol. Asses.: *DiLorenzo et al. (1993) concluded that deepening efforts were projected to have a negligible effect on tidal regime and saltwater intrusion within the Delaware Estuary.*

Comment: A 0.10 to 0.25 ppt increase in salinity is not negligible when considering the habitat requirements for larval and juvenile Atlantic sturgeon. This increase represents significant habitat loss for larval and early stage juveniles. The effects of which are compounded when considered along with the effects of sea level rise.

Biol. Asses.: *In the Delaware River, subadult Atlantic sturgeon are known to congregate and overwinter within brackish river waters (Brundage and Meadows, 1982), however, spawning locations within the Delaware River are currently unknown. Previous studies have noted that subadult Atlantic sturgeon typically occupy both the oligohaline and moderately mesohaline (<10ppt) environments (Dovel and Berggren, 1983; Kiefer and Kynard, 1993; Moser and Ross, 1995; Simpson, 2008). Based on available information within the Delaware Estuary, conclusions regarding the potential impact to Atlantic sturgeon as a result of a small increase in salinity in the Delaware River cannot be drawn at this time.*

Comment: Late stage juveniles shift habitat upstream in years with increased salinity (McCord et al 2007, Hatin et al. 2007, Fisher 2011). Due to the narrowing of deepwater habitat from the lower to the upper estuary, the conclusion should be that an increase in salinity is a loss of habitat. Larval and early stage juvenile habitat (<0.5 ppt) requirements are not discussed. This is immediately relevant in the Delaware because successful spawning was documented by the DFW's capture of a young of the year (178 mm TL) juvenile Atlantic sturgeon in 2009. Additional young of the year were captured in 2009, suggesting a sizeable year class. Hatin et al. 2007 concluded from bottom salinity modeling and young of the year Atlantic sturgeon capture locations in the St. Lawrence that they occupied freshwater (<0.5ppt) only. Salinity at capture and manual tracking locations of age-0 Atlantic sturgeon in 2009 by DFW ranged from 0.0 to 0.4 ppt. Because of the freshwater requirements for this life phase any increase in salinity will reduce habitat. As habitat shifts upstream, area is lost due to the narrowing shape of the estuary and the end of tidal habitat at the Trenton fall line does not shift in accord with the salinity downriver. The same is true for larval stage and spawning habitat.

5.1.4 Impacts to food resources

Biol. Asses.: *It is unlikely that the blasting of rock to deepen the navigation channel will have a significant impact on the food source of sturgeons since the fish do minimal foraging during the time period when blasting would occur (winter) and since Corbicula, their predominant food source, is widespread in the fresh water shallower portions of the Delaware Estuary in more preferred habitats.*

Comment: There is no evidence cited that supports *Corbicula* as the Atlantic sturgeon's primary food source. DFW found only amphipods in the stomachs of juvenile Atlantic sturgeon (field observations, unpublished data) in the Marcus Hook area and there were ample amounts of *Corbicula* in adjacent shallow waters. Refer to Figures 1-4 to note that Atlantic sturgeon prefer and forage in deepwater habitat. Blasting is likely to impact food sources beyond the blasting window. Although this effect is temporary until re-colonization, dredging and blasting activities will temporarily reduce food supply and may have an effect on growth and survival of Atlantic sturgeon.

Biol. Asses.: *…..As stated above, however, Corbicula is widespread throughout other portions of the river so any reduction in biomass should not have a significant impact on sturgeon feeding.*

Comment: There is no evidence cited that supports *Corbicula* as the Atlantic sturgeon's primary food source. A review of Atlantic sturgeon locations in Figures 1-4 and the plans to deepen the federal channel as well as the Marcus Hook anchorage may impact a significant amount of food available for juvenile sturgeon in documented high use areas. The Delaware River is unlike the Delaware Bay and other systems in that a greater portion of the deepwater habitat is found in federal channel and anchorages. Alternative forage areas within acceptable habitat limits for temporary displacement from scour areas are limited in supply.

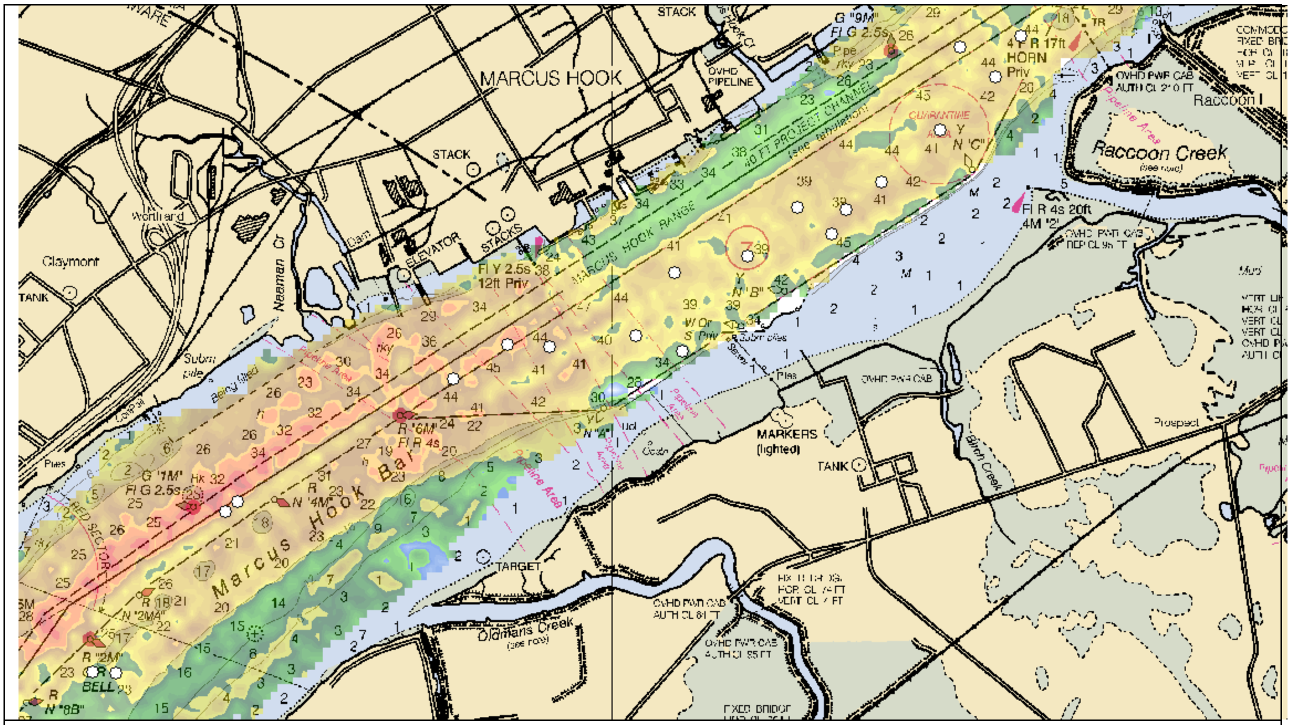


Figure 1. White dots represent manual tracking locations of five Atlantic sturgeon juveniles (608-662 mm TL) tagged from October 25th to November 23rd, 2010 at Carney's point (rkm 114) and Tinicum Island (rkm 142). The tracking area extended from Artificial Island (rkm 88) to Commodore Barry Bridge (rkm 134) with the effort area divided by the Delaware Memorial Bridge for logistical reasons. Tracking occurred when the river was clear of ice (n=9) from January 4th through March 1st, 2011. Manual tracking is accomplished with a VR100 VEMCO hydrophone by triangulation of sturgeon position and angling a directional hydrophone downward directly over the fish and noting GPS location. The red, yellow and green shading represent bottom type as described by the benthic mapping program (DNREC). Red is hard bottom; rock and bedrock, yellow is small cobble and sand and green is silt and mud. A 6th fish was located adjacent to the federal channel in the New Castle range over fine silt and sand (rkm 109, 39.65538, -75.5487). Passive telemetry data indicates this 6th sturgeon overwintered above Philadelphia out of tracking range. Five additional juveniles (608-672 mm TL) received transmitters in the Fall of 2010 and were not detected in the river during the tracking period. Four of those 5 were detected offshore (D. Fox pers. com).

Comments drafted by Matt Fisher and Stewart Michels-Division of Fish and Wildlife-DNREC

June 22, 2011

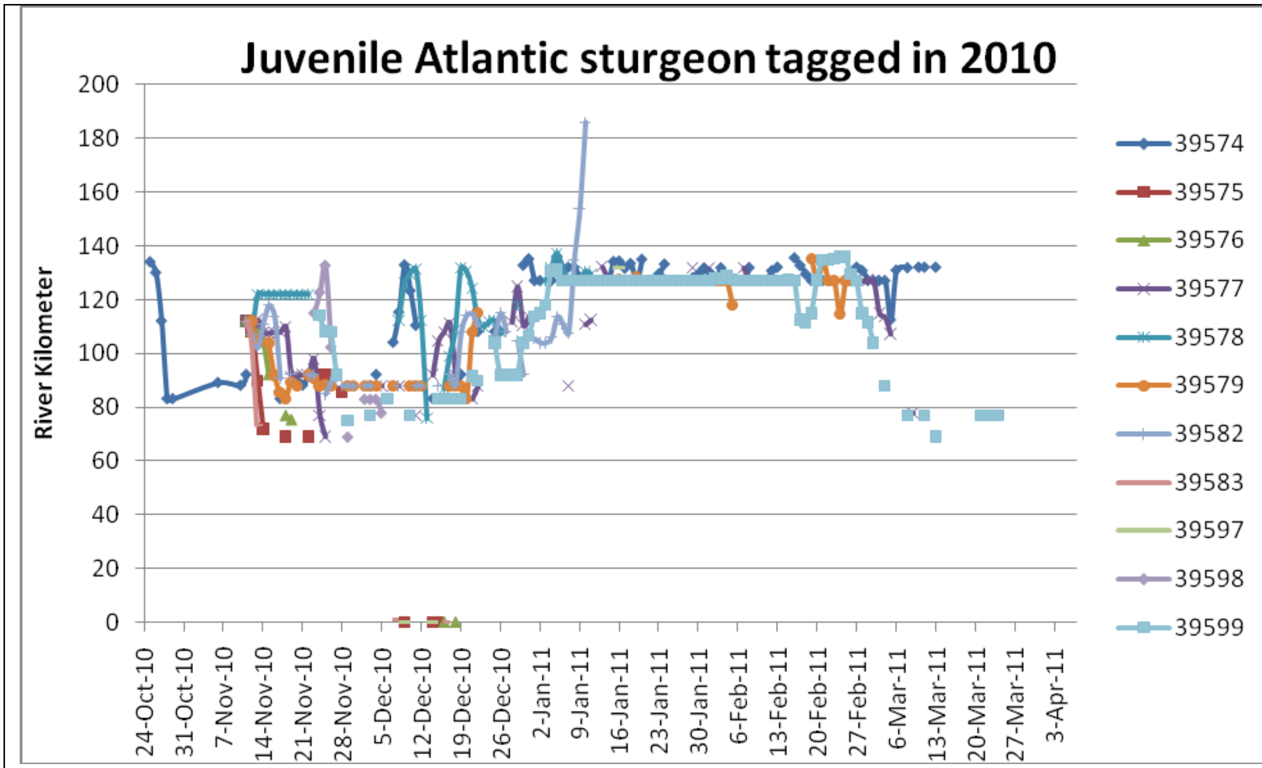


Figure 2. Colored lines and symbols represent juvenile Atlantic sturgeon (608-672 mm TL, n=11) that were implanted with VEMCO V8 and V9 transmitters and monitored by the Delaware Estuary receiver array. River kilometer(rkm) is expressed as a daily average rkm location. The estuary array coverage is sparse below rkm 70 and receivers are pulled for the winter months. This is the likely reason there were no detections except for 4 individuals detected offshore (and subsequently plotted at rkm 0 on the X-axis). Six of the 11 individuals remained in the estuary with one unable to be located in the winter months but it is believed to have left the Estuary for the winter. Five of the 6 juveniles exhibited preference for the 127-133 rkm (Marcus Hook Bar, Anchorage and Range) in the winter months. Transmitters expired on March 9th and March 24th, 2011.

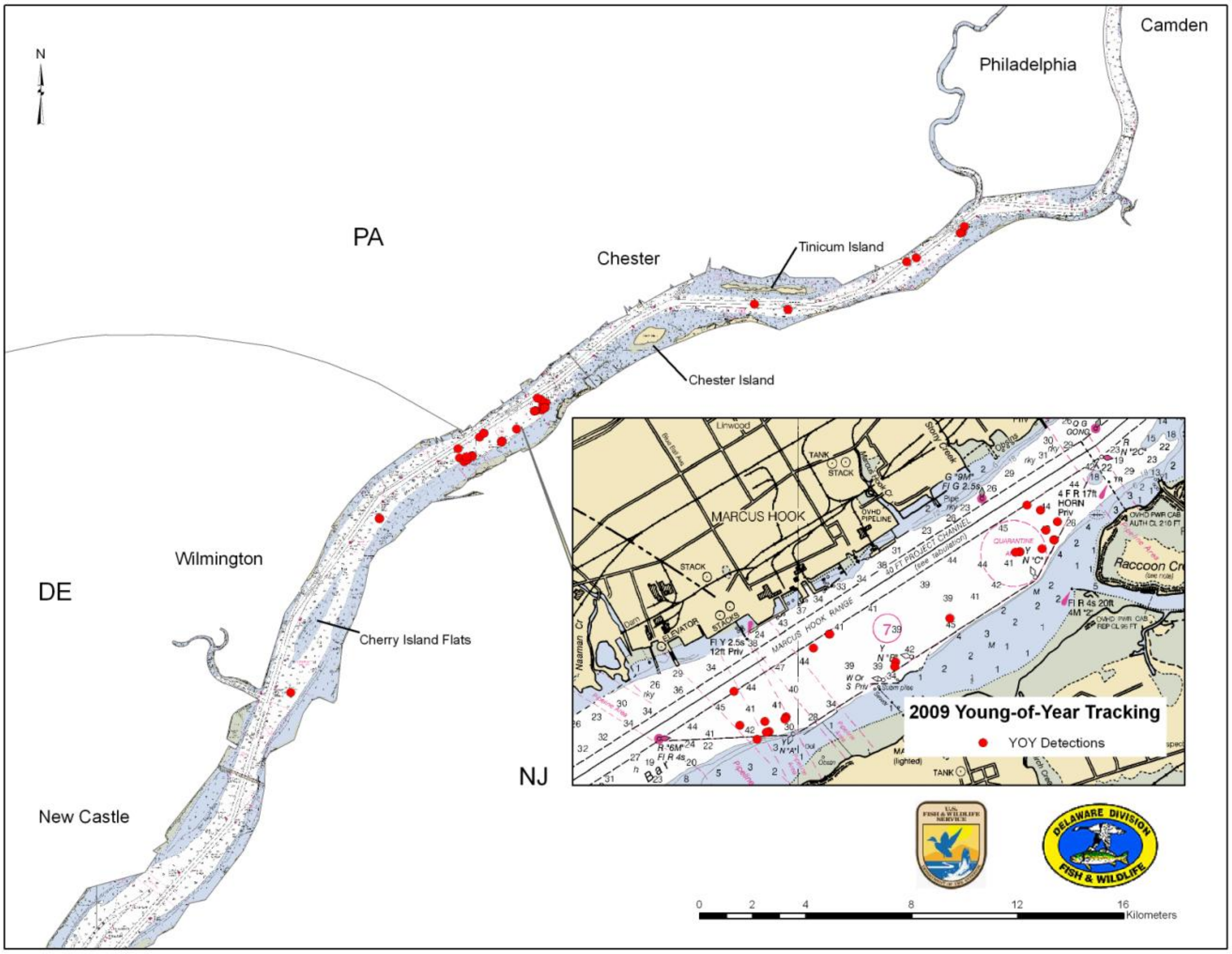
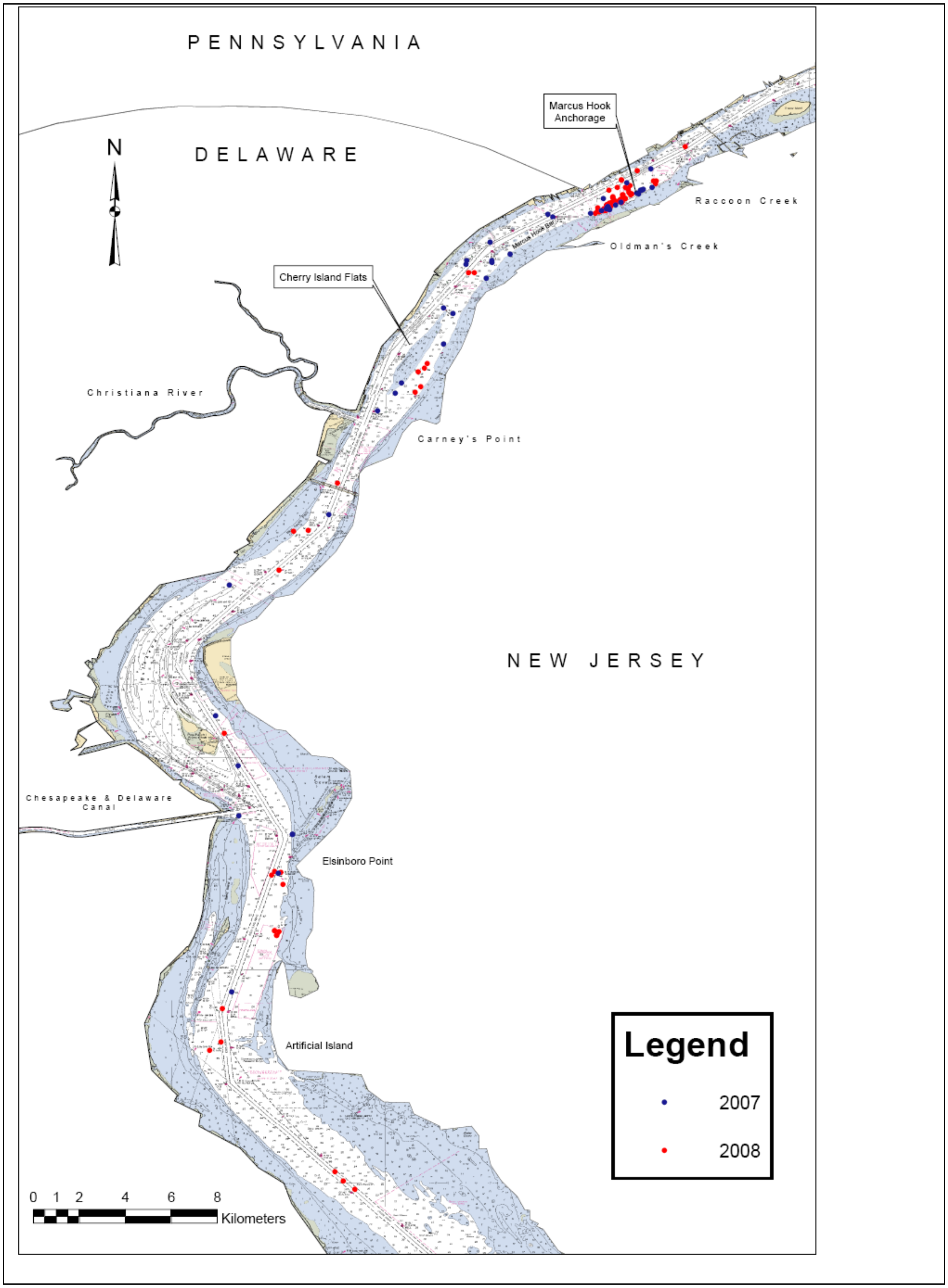


Figure 3. Manual tracking locations of transmitter (VEMCO) implanted Young of the Year (262-349mm TL) Atlantic sturgeon from October 26th to December 15th, 2009. Weekly tracking ranged from the Delaware Memorial Bridge to the mouth of the Schuylkill River. During the tracking period several individuals moved up river out of tracking range. All fish were released at the Marcus Hook anchorage (expanded map section) from September 24th to November 9th, 2009 with the majority of fish being released on October 27th.



PENNSYLVANIA
DELAWARE
N
Marcus Hook Anchorage
Raccoon Creek
Oldman's Creek
Cherry Island Flats
Christiana River
Carney's Point
NEW JERSEY
Chesapeake & Delaware Canal
Elsinboro Point
Artificial Island
Legend
2007
2008
0 1 2 4 6 8
Kilometers

Figure 4. Manual tracking in 2007 and 2008 yielded high numbers of DFW tagged late stage juvenile Atlantic sturgeon in Marcus Hook anchorage and less frequent numbers throughout the survey area (Artificial Island to Commodore Barry Bridge). Tracking occurred from July to October.

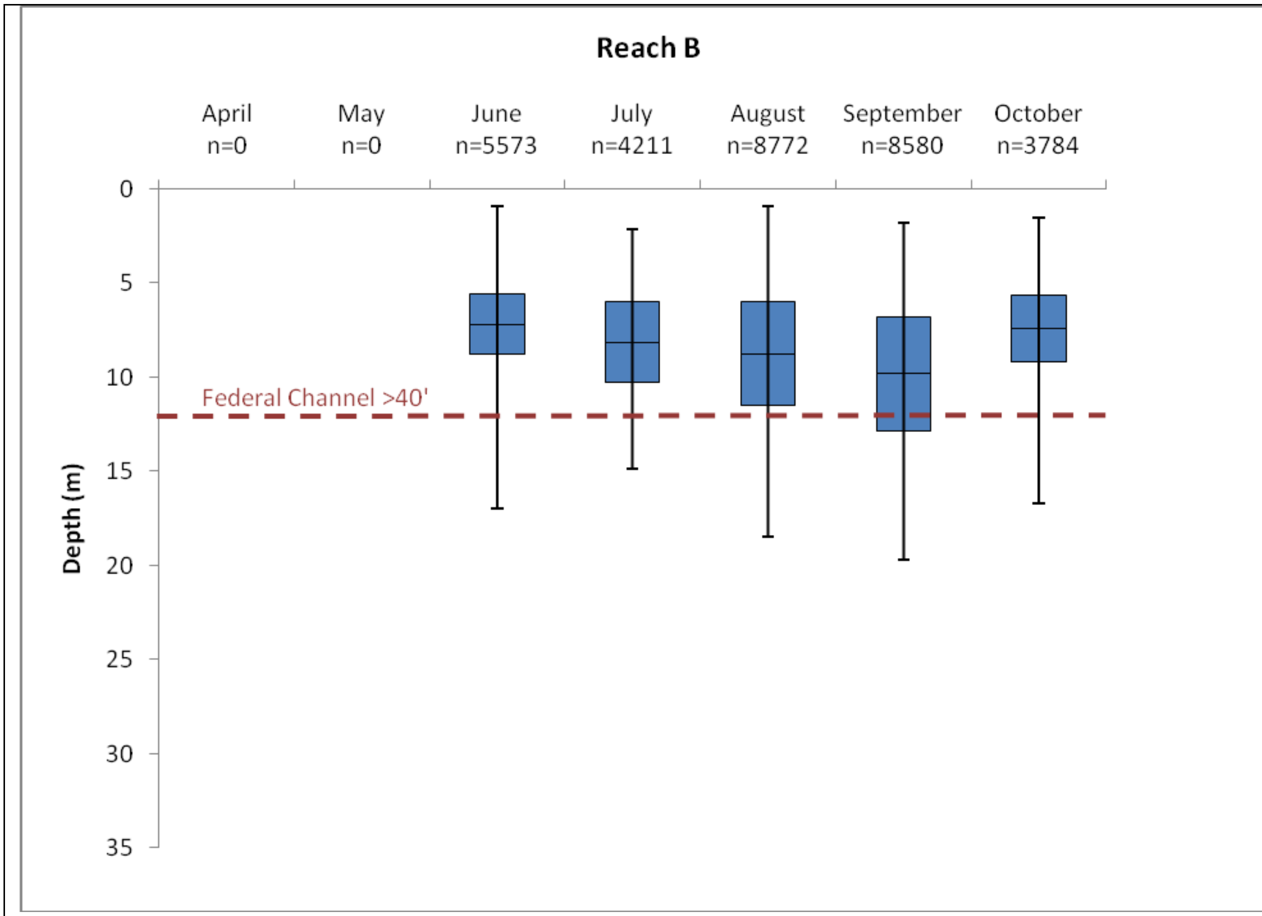


Figure 5. Box and whisker plot of late stage juvenile Atlantic sturgeon depth in Reach B 2008 by month. Reach B extends from Tinicum Range, located opposite the airport to Cherry Island Range, located opposite of Wilmington, DE. Box represents the depth of the 25th through 75th quartile of detections.

Horizontal line within the box represents the average depth. Whiskers represent the minimum and maximum depth. Available detection depth of receiver varies by receiver location. Transmitter pressure sensor is accurate ±3.4m.

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